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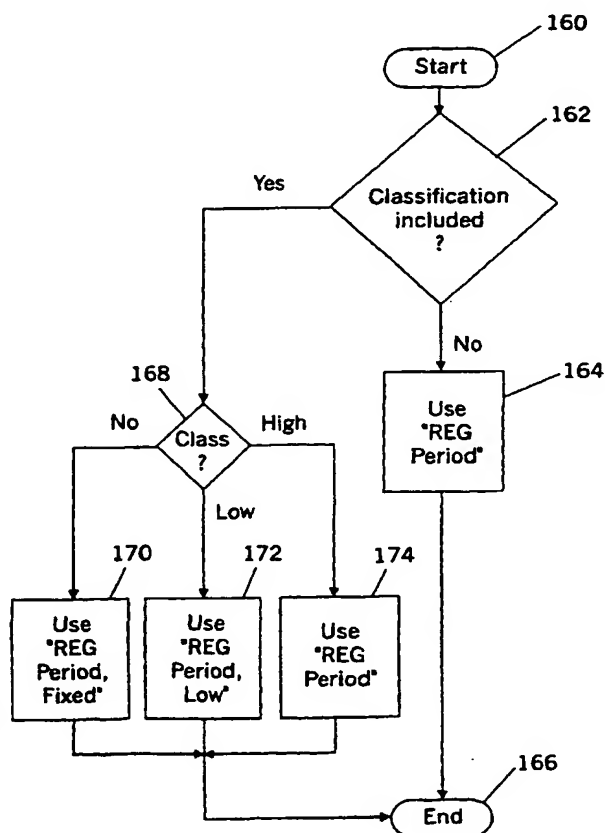
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(54) Title: APPARATUS AND METHOD FOR PERIODIC REGISTRATION OF A MOBILE TERMINAL WITH A WIRELESS COMMUNICATIONS SYSTEM



(57) Abstract: There is disclosed herein a method and system for periodic registration of a mobile terminal in a wireless communications system. A mobile switching center operatively receives an initial registration message from the mobile terminal. The registration message identifies the mobile terminal. The mobile switching center determines a mobility classification assigned to the mobile terminal and transmits a registration accept message to the mobile terminal indicating that the mobile terminal has successfully registered on the wireless communications system. The registration accept message comprises the determined mobility classification assigned to the mobile terminal. The mobile terminal receives the registration accept message and determines if the mobility classification is included in the registration accept message and periodically registers the mobile terminal with the wireless communications system at a time interval associated with the mobility classification.

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## APPARATUS AND METHOD FOR PERIODIC REGISTRATION OF A MOBILE TERMINAL WITH A WIRELESS COMMUNICATIONS SYSTEM

### BACKGROUND OF THE INVENTION

5 The present invention is directed toward wireless communications systems and, more particularly, to an apparatus and method for periodic registration of a mobile terminal with a wireless communications system.

10 Wireless communications systems, such as mobile communications systems, typically consist of pluralities of different subsystems. A mobile terminal, typically called a mobile communications telephone in a mobile communications system, is used to make and receive wireless calls or perform data transactions. The mobile terminal communicates with the mobile communications system via base stations which are geographically dispersed about an area of coverage of the mobile communications system, with each base station having its own associated area of coverage. Communication between the mobile terminal and the base stations occurs via radio transmissions.

15 In order for the mobile communications system to keep track of the location of the mobile terminal, a process commonly known as registration is typically utilized. When a mobile terminal is first powered up, or when it changes its location area, it must register its location with the mobile communications system. There may also be other reasons to require the mobile terminal to register with the mobile communications system. Registration, as used herein, means transmitting a message, referred to herein as a registration message, from the mobile terminal to the mobile

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communications system informing the mobile communications system of the transmitting mobile terminal's identity and location. Typically, the location of the mobile terminal is deduced by the mobile communications system based on which base station receives the registration message.

5 The mobile communications system either accepts the registration, in which case the mobile terminal is considered "logged on" to the mobile communications system, or it rejects the registration. If the registration is rejected, the mobile communications system typically informs the mobile terminal, via a registration reject message, of why the registration was

10 rejected.

Periodic registration is a feature utilized in many mobile communications systems. It is a registration that is performed at regular intervals to inform the mobile communications system that the mobile terminal is still available. The mobile terminal uses an internal timer to determine

15 when to send a periodic registration message. When the timer expires, the mobile terminal transmits the periodic registration message to the mobile communications system. The timer is reset every time a registration message has been transmitted by the mobile terminal. The length of the timer is either fixed or is broadcast on a control channel by the mobile communications system to all mobile terminals within its area of coverage.

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The mobile communications system also uses a timer for each mobile terminal, this timer being slightly longer than the one used by the mobile terminal, to determine that a mobile terminal is no longer available, i.e., not in contact with the mobile communications system. The timer

25 used by the mobile communications system is reset when the mobile com-

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5        munications system receives a registration message from a mobile terminal. When the mobile communications system timer expires and the mobile communications system has not received a registration message from the mobile terminal, the mobile communications system determines that the mobile terminal is no longer available.

10        In mobile communications systems, since communication between the mobile terminal and base station is based on radio transmissions, reliability is a concern. Radio transmissions can be distorted or prevented due to many factors. For example, a mobile terminal may be moved into an elevator, tunnel, or underground where the radio signals from the base station will not reach it, and vice versa. A mobile terminal could also have moved too far away from the closest base station to be able to maintain radio contact. Further, the mobile terminal may simply have been powered down.

15        When the mobile communications system receives a call destined to a mobile terminal within its area of coverage, it will page the mobile terminal in every base station in the location area where the mobile terminal is located. In order to reduce the amount of paging messages transmitted, the mobile communications system will utilize information about when the mobile terminal is not available and, in those cases, not send a paging message. For example, if the mobile terminal informs the mobile communications system that it is about to power down, the mobile communications system retains this information and does not send paging messages to the mobile terminal until the mobile terminal powers up again and registers with the mobile communications system. However, when a

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mobile terminal loses connection with the mobile communications system because it unexpectedly moves into a tunnel or moves underground, the mobile terminal may not be able to transmit a message to the mobile communications system informing the mobile communications system that it will be unavailable, since the mobile terminal did not know in advance that such an occurrence was about to happen. In these instances, the mobile terminal leaves the mobile communications system quietly without being able to inform the mobile communications system of the fact that it has become unavailable. By using periodic registration, the mobile communications system is alerted that the mobile terminal did not register at its predefined time and that it is no longer available. Therefore, if a call is received for the mobile terminal, the mobile communications system knows not to page the mobile terminal since it is unavailable.

A problem with existing periodic registration mechanisms is that they do not take into account the different types of mobile terminals which may be utilized in mobile communications systems. Typically, the mobile terminal is a mobile communications telephone that a subscriber carries around with him/her. However, there are many other types of mobile terminals capable of use in mobile communications systems. One is a communication card that is inserted into a portable computer and used for wireless data communication. Another may be a device connected to a vending machine that transmits information, via the mobile communications system, concerning the amount of product still available in the machine. The mobile terminal may also be a device connected to a utility meter that transmits information, via the mobile communications system,

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concerning the amount of water, electricity, gas, etc., that has been used. These latter types of mobile terminals, namely, the ones connected to other machines, are sometimes referred to as modules.

5 The module-type mobile terminals do not move, or move very infrequently, and therefore, will generally not lose connection to the base station. Thus, using typical periodic registration mechanisms, the module-type mobile terminals will send a lot of unnecessary registration messages and take up radio bandwidth. While the module-type mobile terminal may lose connection to the base station due to extreme weather conditions,  
10 physical damage to the mobile terminal or base station, etc., this generally happens very infrequently.

Mobile communications systems are also sometimes used to provide access to fixed subscribers. These types of systems are sometimes called "Fixed Wireless Access Systems" or "Wireless in the Local  
15 Loop Systems". Mobile terminals utilized in these types of systems are fixed and cannot move. Again, with existing periodic registration mechanisms, these mobile terminals will send a lot of unnecessary registration messages and take up radio bandwidth. A mobile communications system may accommodate both fixed mobile terminals and regular mobile terminals.  
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#### SUMMARY OF THE INVENTION

A method of periodically registering certain classifications of mobile terminals with a wireless communication system is provided. The method includes the steps of receiving, at a wireless communications

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system, an initial registration message from a mobile terminal within an area of coverage of the wireless communications system, the registration message identifying the mobile terminal. A mobility classification assigned to the mobile terminal is determined and the mobile terminal is instructed to  
5 periodically register with the wireless communications system at a periodic time interval associated with the determined mobility classification of the mobile terminal.

The various classifications for the mobile terminal may be selected from the group consisting of high mobility, low mobility and no  
10 mobility. The periodic time interval associated with high mobility is of a shorter duration than the periodic time interval associated with low mobility. Further, the periodic time interval associated with low mobility is of a shorter duration than the periodic time interval associated with no mobility. It is contemplated that one of the periodic time intervals may include infin-  
15 ity, meaning that the mobile terminal should not periodically register with the wireless communications system.

The wireless communications system includes at least one home location register which stores mobile terminal subscriber information. The mobility classifications assigned to the mobile terminals operating  
20 within the wireless communications system are stored in the home location register associated with that particular mobile terminal. These mobility classifications may be changed by a system operator.

If a mobility classification assigned to a mobile terminal is unable to be determined, the mobile terminal is instructed to periodically



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register with the wireless communications system at a default periodic time interval.

5 An alternative method of periodically registering a mobile terminal with a wireless communications system is also provided. The method includes the steps of receiving, at the mobile terminal, subsequent to an initial registration message from the mobile terminal, a registration accept message from the wireless communications system, and determining if a periodic registration time interval associated with the mobile terminal is included in the registration accept message. If it is determined that  
10 a periodic registration time interval is included in the registration accept message, the included periodic registration time interval is used for periodic registration of the mobile terminal with the wireless communications system. If it is determined that a periodic registration time interval is not included in the registration accept message, a default periodic registration  
15 time interval is used for periodic registration of the mobile terminal with the wireless communications system.

Other aspects, objects and advantages of the present invention can be obtained from a study of the application, the drawings, and the appended claims.

## 20 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a mobile communications system;

Fig. 2 is a block diagram of a mobile communications system incorporating the inventive method for periodic registration;

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Fig. 3 is a sequence diagram illustrating the inventive periodic registration technique;

Fig. 4 is a flow chart illustrating the inventive periodic registration technique;

5 Fig. 5 is a sequence diagram illustrating an alternative form of the inventive periodic registration technique;

Fig. 6 is a block diagram illustrating the alternative form of the inventive periodic registration technique; and

Fig. 7 is a block diagram of a typical mobile terminal.

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#### DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a block diagram of a typical mobile communications system, such as ANSI-136 or GSM (Global System for Mobile Communications), shown generally at 10. The mobile communications system 10 includes a plurality of Mobile Switching Centers (MSC) 12 and 14 (for convenience, only two MSC's are shown in Fig. 1), with each MSC 12,14 having an associated Visitor Location Register (VLR) 16 and 18, respectively. Each MSC 12,14 within the mobile communications system 10 is typically connected to non-mobile communications systems such as, for example, a Public Switched Telephone Network (PSTN) 20, an Integrated Services Digital Network (ISDN) 22, and a Public Packet Data Systems Network (PDSN) 24, such as the Internet.

Each MSC 12,14 services a different service area within the mobile communications system 10. Each MSC 12,14 has an associated plurality of Base Stations (BS) dispersed throughout the geographic extent

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of its service area, with each BS servicing a sub-area within the service area of its respective MSC. For convenience, only two BS's 26 and 28 are shown associated with the MSC 12, and one BS 30 is shown associated with the MSC 14.

5                   A mobile terminal, identified herein as MT 32, operating within an area of coverage of the BS 28 communicates with the mobile communications system 10 via the BS 28. The MT 32 uses radio transmissions to send and receive information, e.g., make and receive mobile communications calls or perform data transactions, to and from the BS 28. Each BS  
10 is connected, typically through an intermediate transmission system such as a base station controller, to its associated MSC. Also in the mobile communications system 10, there is typically a main subscriber database, often called a Home Location Register (HLR) 34, where relevant information about subscriptions (subscriber data) is stored. Such subscriber data typi-  
15 cally includes information such as the services that a particular subscriber is permitted to use and the location of the subscriber.

                  A local copy of the subscriber data from the HLR 34 is stored in the VLR when the MT is in an area of coverage associated with the VLR. For example, in the mobile communications system 10 shown in Fig. 1, the  
20 subscriber data associated with the MT 32 is stored in the HLR 34 and a local copy of the subscriber data is stored in the VLR 16. The copy stored in the VLR 16 does not necessarily contain all the information about the subscription that is available in the HLR 34, and may contain additional information with only local significance. For example, while the HLR 34  
25 may only have information about the particular MSC/VLR in which the

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subscriber is located, the VLR in which the subscriber is located may have more detailed location information.

When a call is made to an MT in a mobile communications system, the MSC where the call originates typically interrogates the HLR to  
5 determine in which MSC/VLR the subscriber is located. The call will then be delivered to that MSC/VLR and the MT will be paged. The paging normally takes place in a subset area that the MSC/VLR serves. This subset area is commonly known as the location area or paging area. The location  
10 area may vary from as small as one BS to as big as the entire service area of the MSC/VLR. For example, in Fig. 1, if a call is placed to the MT 32, the HLR 34 is interrogated to determine in which MSC/VLR the MT 32 is located. The call is then delivered to the MSC/VLR 12/16, and the MT 32 is paged.

As previously noted, in order for the mobile communications  
15 system 10 to keep track of the location of the MT 32, a process commonly known as periodic registration is used.

Fig. 2 is a block diagram of a mobile communications system shown generally at 100 incorporating the inventive method. The mobile communications system 100 includes MSC's 102 and 104 each servicing  
20 a different coverage area within the mobile communications system 100. Each MSC 102, 104 conventionally communicates with an associated VLR 106, 108. An HLR 110 includes information about the subscriptions and communicates with each MSC/VLR combination. The MSC's 102, 104 are also connected to non-mobile communications systems, such as a Public

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Switched Telephone Network 112, a Public Packet Data Systems Network 114, such as the Internet, and an Integrated Services Digital Network 116.

Each MSC 102,104 has an associated number of BS's dispersed throughout its area of coverage sufficient to cover the entire area. As shown in Fig. 2, the MSC 102 communicates with BS's 118 and 120, while the MSC 104 communicates with BS 122. However, any number of BS's sufficient to cover the MSC's area of coverage is within the scope of the present invention.

As shown in Fig. 2, it is assumed that MT's 124, 126, 128 are within the area of coverage of MSC 102 and are communicating therewith via BS 118. In order to utilize the fact that different kinds of MT's behave differently with regard to mobility, the present invention proposes that information about an MT's mobility type be stored in the HLR 110. This information is then be provided to the appropriate VLR via a message that is conventionally used for downloading subscription information from the HLR 110 to the VLR 106 or 108. The various types of designations used for different MT's are referred to herein as high mobility (MT 128), low mobility (MT 126) and no mobility (MT 124). It should be understood, however, that the present invention is not limited to three distinct class designations, and any number of type designations may be utilized without the departing from the spirit and scope thereof.

The present invention is described herein in the context of a mobile terminal. As used herein, the term "mobile terminal" may include a mobile communications radiotelephone with or without a multi-line display; a Personal Communications System (PCS) terminal that may combine a

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mobile communications radiotelephone with data processing, facsimile and data communications capabilities; a PDA that can include a radiotelephone, pager, Internet/intranet access, Web browser, organizer, calendar and/or a global positioning system (GPS) receiver; and a conventional laptop and/or palmtop receiver or other appliance that includes a radiotelephone transceiver. Mobile terminals may also be referred to as "pervasive computing" devices.

The high mobility designation may be used for regular cell phones and communication cards for portable computers, as well as other types of mobile terminals that regularly move from one location to another and that also need to be able to communicate while in motion. The low mobility designation may be used for mobile terminals that move infrequently, such as those connected to vending machines and other fixed equipment. The no mobility designation may be used for mobile terminals that the mobile communications system operator does not want to give the ability to move around in the system.

In order to avoid unnecessary signaling in the system, the timer used by the mobile terminals to send periodic registrations will differ from mobility designation to mobility designation. The periodic registration timer for a no mobility MT will be longer than that for a low mobility MT; whereas the periodic registration timer for a low mobility MT will be longer than for a high mobility MT. Moreover, the MSC/VLR will not accept the registration signal from a MT designated as no mobility when the MT is not in its intended location.

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The period timer values for each class of mobile terminal are broadcast by the mobile communications system on the control channel. One of the values that may be broadcast should be "infinity", signifying that this particular class of MT should do no periodic registration at all.

5                    Fig. 3 is a sequence diagram for periodic registration according to the present invention. When the mobile terminal (MT 124, MT 126, or MT 128) is first powered up, it reads the broadcast information broadcast by the mobile communications system 100 on the control channel (F-BCHH) at step 130. Included in the broadcast information are the parameters "REG Period", "REG Period Low", and "REG Period Fixed". These  
10                    parameters are included in the registration parameters message on the control channel and identify the time period between each periodic registration for the high mobility MT 128 (REG Period), the low mobility MT 126 (REG Period Low) and the no mobility MT 124 (REG Period Fixed). If one  
15                    of the parameters is not included on the control channel, it is an indication to that particular class of MT not to use periodic registration.

                  The MT, at step 132, formulates a registration message that it sends on the RACH, which notifies the MSC 102 that the MT is now present in its service area. The MSC 102 sends a registration notification  
20                    message (REGNOT) to the VLR 106 at step 134. The VLR 106 then transmits a registration notification message (REGNOT) to the HLR 110 at step 136. The HLR 110 sends a registration cancellation message (REGCANC) to the previous VLR (OLD VLR) 108 in which the MT was registered at step 138. The OLD VLR 108 then sends a registration cancellation message  
25                    (REGCANC) to the previous MSC (OLD MSC) 104 in which the MT was

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registered at step 140. The OLD MSC 104 answers the OLD VLR 108 with a registration cancellation result message (regcanc) at step 142. The OLD VLR 108 sends a registration cancellation result message (regcanc) to the HLR 110 at step 144.

5                   The HLR 110 sends a registration notification result message (regnot) to the VLR 106 at step 146. This message includes a profile parameter which contains subscription-related information such as which features the subscriber has activated and which language the subscriber prefers to use. This parameter will also include information about which  
10                   class the MT belong to, such as high mobility (MT 128), low mobility (MT 126) or no mobility (MT 124). The VLR 106 sends a registration notification result message (regnot) to the MSC 102 at step 148. The profile parameter is included in this message as well, and the regnot message also includes information about which class the MT belongs to, e.g., high mobility,  
15                   low mobility, or no mobility. The MSC 102 transmits a registration accept message to the MT at step 150 indicating that the MT has successfully registered on the mobile communications system 100. The registration accept message will include a new parameter which will contain information regarding which class the MT belong to, e.g., high mobility, low  
20                   mobility, or no mobility. Depending upon which class the MT belongs to, it will wait the amount of time specified in the appropriate parameter, REG Period, REG Period Low, or REG Period Fixed that the MT read at step 130. During this time, the MT may make and receive calls. Upon expiration of the appropriate periodic registration timer, the MT transmits a registration  
25                   message to the MSC 102 at step 152. This message will include a



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5 registration-type parameter set to periodic. The MSC 102 then sends a registration accept message back to the MT at step 154, indicating that the MT has successfully performed a periodic registration on the mobile communications system 100. Steps 152 and 154 will be repeated at the appropriate periodic interval until the MT is turned off or moves to a new cell in which periodic registration is not utilized.

10 If the MT happens to be moved to an area with no radio coverage or loses radio coverage for some reason, for example, atmospheric disturbance, the timer for periodic registration will expire and the MSC 102 will not receive a periodic registration message from the MT. The MSC 102 will notice that the MT did not send the periodic registration based upon a particular timer set for that particular MT's class and will conclude that the MT is outside of its area of radio coverage. Any future calls to the MT will be answered by the MSC 102 with an out-of-coverage treatment message until the MT sends a registration message back to the MSC 102.

15 Fig. 4 is a flow chart of the inventive periodic registration method utilized by the MT. The method starts at block 160 with the MT receiving a registration accept message from the MSC 102. At block 160, the MT has already read the parameters REG Period, REG Period Low, and  
20 REG Period Fixed broadcast on the control channel of the mobile communications system 100. The MT reads the registration accept message and determines if a mobility classification is included in the registration accept message at block 162. If not, the MT uses the time period identified by the parameter REG Period for periodic registration at block 164, and the method  
25 ends at block 166.

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If a mobility classification is included in the registration accept message at block 162, the MT determines the particular classification at block 168. If it is determined that the classification is no mobility at block 168, the MT uses the time period identified by the parameter REG Period Fixed for periodic registration at block 170, and the method ends at block 166. If it is determined that the classification is low mobility at block 168, the MT uses the time period identified by the parameter REG Period Low for periodic registration at block 172, and the method ends at block 166. If it is determined that the classification is high mobility at block 168, the MT uses the time period identified by the parameter REG Period for periodic registration at block 174, and the method ends at block 166. While the time period identified by the parameter REG Period is used for both high mobility and when no mobility classification of MT is indicated in the registration accept message, a default value may be used instead of REG Period if no mobility classification is indicated in the registration accept message.

As an alternate embodiment, instead of classifying mobile terminals into various classes of mobility, specific timer values for each particular mobile terminal may be stored in the HLR 110. Thus, instead of a mobile terminal having to determine a mobility classification from the registration accept message and choose a periodic timer value for use based upon the determined mobility classification, the mobile terminal receives a timer value that it is to use for periodic registration.

Fig. 5 is a sequence diagram for periodic registration according to this alternate embodiment. When the MT (124,126,128) is first powered up, it will read broadcast information broadcast on the control channel

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(F-BCCH) of the mobile communications system 100 at step 180. One parameter it will read is REG Period, which identifies the time period between each periodic registration for MT's that do not receive an individual periodic registration timer in the registration accept message. The MT

5 formulates a registration message that it sends on the RACH at step 182, notifying the MSC 102 that it is now in its service area. The MSC 102 sends a registration notification message (REGNOT) to the VLR 106 at step 184. The VLR 106 sends a registration notification message (REGNOT) to the HLR 110 at step 186. The HLR 110 sends a registration cancellation

10 message (REGCANC) to the previous VLR (OLD VLR) 108 in which the MT was registered at step 188. The OLD VLR 108 sends a registration cancellation message (REGCANC) to the previous MSC (OLD MSC) 104 in which the MT was registered at step 190. The OLD MSC 104 answers the OLD VLR 108 with a registration cancellation result message (regcanc) at step

15 192. The OLD VLR 108 answers the HLR 110 with a registration cancellation result message (regcanc) at step 194. The HLR 110 answers the VLR 106 with a registration notification result message (regnot) at step 196. This message includes a profile parameter which contains subscription related information such as which features the subscriber has activated and

20 which language the subscriber prefers to use, and also includes information regarding the length of the periodic registration timer for that particular MT. One value will signify that periodic registration is not used for that particular MT. The VLR 106 answers the MSC 102 with a registration notification result message (regnot) at step 198. The profile parameter is included in

25 this message as well. The MSC 102 sends a registration accept message

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to the MT at step 200, indicating that the MT has successfully registered on the system. Included in the registration accept message from the MSC 102 is a periodic registration timer parameter that includes information regarding the length of the periodic timer value. One value will signify that  
5 periodic registration is not used for this particular MT.

The MT waits for the amount of time specified in the periodic registration timer parameter and, upon expiration thereof, sends a registration message to the MSC 102 at step 202. This message contains a registration type parameter set to periodic. The MSC 102 sends a registration  
10 accept message to the MT at step 204 and the MT has successfully performed a periodic registration on the mobile communications system 100. If the MT did not receive the periodic registration timer parameter in the registration accept message at step 200, the MT would use the registration timer broadcast in the REG Period parameter. If the timer for periodic  
15 registration expires and the MSC 102 has not received a periodic registration message from the MT, the MSC 102 concludes that the MT is outside of its area coverage and any future calls to that particular MT will be answered with an out-of-coverage treatment message until the MT sends a registration message back to the MSC 102.

20 Fig. 6 is a flow chart illustrating a method for periodic registration according to the alternate embodiment. The method starts at block 210 with the MT receiving the registration accept message from the MSC 102. At step 210, the MT has already read the parameter REG Period broadcast on the control channel. The MT analyzes the registration accept  
25 message and determines if a periodic registration timer value is included in

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the registration accept message at block 212. If it is determined that a periodic registration timer was included in the registration accept message at block 212, the MT uses that periodic registration timer for periodic registration at block 214, and the method ends at block 216. If it is determined that no periodic registration timer was included in the registration accept message at block 212, the MT uses the timer value associated with the parameter REG Period for periodic registration at block 218, the method ends at block 216.

Fig. 7 is a block diagram of a typical mobile terminal, such as the MT 128. The MT 128 includes an antenna 312, a receiver 316, a transmitter, 318, a speaker 320, a processor 322, a memory 324, a user interface 326 and a microphone 332. The antenna 312 is configured to send and receive radio signals between the MT 128 and the wireless network. The antenna 312 is connected to a duplex filter 314 which enables the receiver 316 and the transmitter 318 to receive and broadcast (respectively) on the same antenna 312. The receiver 316 demodulates, demultiplexes and decodes the radio signals into one or more channels. Such channels include a control channel and a traffic channel for speech or data. The speech or data are delivered to the speaker 320 (or other output device, such as a modem or fax connector).

The receiver 316 delivers messages from the control channel to the processor 322. The processor 322 controls and coordinates the functioning of the MT 128 and is responsive to messages on the control channel using programs and data stored in the memory 324, so that the MT 128 can operate within the wireless network. The processor 322 also

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controls the operation of the MT 128 and is responsive to input from the user interface 326. The user interface 326 includes a keypad 328 as a user-input device and a display 330 to give the user information. Other devices are frequently included in the user interface 326, such as lights and special purpose buttons. The processor 322 controls the operations of the transmitter 318 and the receiver 316 over control lines 334 and 336, respectively, responsive to control messages and user input.

The microphone 332 (or other data input device) receives speech signal input and converts the input into analog electrical signals. The analog electrical signals are delivered to the transmitter 318. The transmitter 318 converts the analog electrical signals into digital data, encodes the data with error detection and correction information and multiplexes this data with control messages from the processor 322. The transmitter 318 modulates this combined data stream and broadcasts the resultant radio signals to the wireless network through the duplex filter 314 and the antenna 312.

While the invention has been described with particular reference to the drawings, it should be understood that various modifications could be made without departing from the spirit and scope of the present invention.

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## CLAIMS

1. A method of periodically registering a mobile terminal with  
2 a wireless communications system, said method comprising:  
receiving an initial registration message from a mobile terminal  
4 within an area of coverage of a wireless communications system, the  
registration message identifying the mobile terminal;  
6 determining a mobility classification assigned to the mobile  
terminal; and  
8 instructing the mobile terminal to periodically register with the  
wireless communications system at a periodic time interval associated with  
10 the determined mobility classification of the mobile terminal.

2. The method of claim 1, wherein the mobility classification  
2 is selected from high mobility, low mobility and no mobility.

3. The method of claim 2, wherein  
2 the periodic time interval associated with high mobility is of a  
shorter duration than the periodic time interval associated with low mobil-  
4 ity, and  
the periodic time interval associated with low mobility is of a  
6 shorter duration than the periodic time interval associated with no mobility.

4. The method of claim 3, wherein the periodic time interval  
2 associated with no mobility comprises infinity.

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2           5. The method of claim 1, wherein the mobility classification assigned to the mobile terminal is stored in a home location register associated with the mobile terminal.

2           6. The method of claim 5, further comprising changing the mobility classification assigned to the mobile terminal to an alternate mobility classification associated with a different periodic time interval.

2           7. The method of claim 1, further comprising:  
4           instructing the mobile terminal to periodically register with the wireless communications system at a default periodic time interval if the mobility classification assigned to the mobile terminal is unable to be determined.

2           8. The method of claim 1, wherein the mobility classification comprises a periodic time interval for registration assigned to the mobile terminal.



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2           9. A method of periodically registering a mobile terminal with  
a wireless communications system, said method comprising:  
            receiving an initial registration message from a mobile terminal  
4           within an area of coverage of a wireless communications system, the  
registration message identifying the mobile terminal;  
6           determining a mobility classification assigned to the mobile  
terminal;  
8           transmitting a registration accept message to the mobile termi-  
nal indicating that the mobile terminal has successfully registered on the  
10          wireless communications system, the registration accept message compris-  
ing the determined mobility classification assigned to the mobile terminal;  
12          and  
            receiving a periodic registration signal at a periodic time inter-  
14          val associated with the determined mobility classification of the mobile  
terminal.

            10. The method of claim 9, further comprising:  
2           transmitting periodic time intervals for periodic registration  
associated with each different mobility classification as broadcast informa-  
4           tion on a control channel; and  
            receiving the broadcast periodic time intervals at the mobile  
6           terminal during initial power up.

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11. The method of claim 10, further comprising:  
2 comparing the received determined mobility classification of  
the mobile terminal with the received broadcast periodic time intervals  
4 associated with each different mobility classification to determine the  
periodic time interval associated with the determined mobility classification  
6 of the mobile terminal.

12. The method of claim 10, further comprising instructing  
2 mobile terminals assigned to a particular mobility classification not to use  
periodic registration if a periodic time interval is not provided for the partic-  
4 ular mobility classification.

13. The method of claim 9, wherein the mobility classifica-  
2 tion is selected from high mobility, low mobility or no mobility.

14. The method of claim 13, wherein  
2 the periodic time interval associated with high mobility is of a  
shorter duration than the periodic time interval associated with low mobil-  
4 ity; and  
the periodic time interval associated with low mobility is of a  
6 shorter duration than the periodic time interval associated with no mobility.

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2           15. The method of claim 14, wherein the periodic time interval associated with no mobility comprises infinity.

2           16. The method of claim 9, wherein the mobility classification assigned to the mobile terminal is stored in a home location register associated with the mobile terminal.

2           17. The method of claim 16, further comprising changing the mobility classification assigned to the mobile terminal to an alternate mobility classification associated with a different periodic time interval.

2           18. The method of claim 9, wherein the mobility classification comprises a periodic time interval for registration assigned to the mobile terminal.

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19. A method of determining a time interval for periodic registration of a mobile terminal with a wireless communications system, said method comprising:
- subsequent to an initial registration message from a mobile terminal, receiving, at the mobile terminal, a registration accept message from a wireless communications system;
  - determining if a mobility classification associated with the mobile terminal is included in the registration accept message;
  - if it is determined that a mobility classification associated with the mobile terminal is included in the registration accept message, determining the mobility classification associated with the mobile terminal, and using, for periodic registration of the mobile terminal with the wireless communications system, a periodic time interval associated with the determined mobility classification; and
  - if it is determined that a mobility classification associated with the mobile terminal is not included in the registration accept message, using, for periodic registration of the mobile terminal with the wireless communications system, a default periodic time interval.

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20. The method of claim 19, wherein the mobility classification is selected from the group consisting of high mobility, low mobility and no mobility, and wherein the periodic time interval associated with high mobility is of a shorter duration than the periodic time interval associated with low mobility, and the periodic time interval associated with low mobility is of a shorter duration than the periodic time interval associated with no mobility.

21. The method of claim 19, further comprising:  
receiving, at the mobile terminal, periodic time intervals for periodic registration associated with each different mobility classification as broadcast information on a control channel of the wireless communications system during mobile terminal power up.

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22. A method of determining a time interval for periodic  
2 registration of a mobile terminal with a wireless communications system,  
said method comprising:

4 subsequent to an initial registration message from a mobile  
terminal, receiving, at the mobile terminal, a registration accept message  
6 from a wireless communications system;

determining if a periodic registration time interval associated  
8 with the mobile terminal is included in the registration accept message;

if it is determined that a periodic registration time interval is  
10 included in the registration accept message, using, for periodic registration  
of the mobile terminal with the wireless communications system, the in-  
12 cluded periodic registration time interval; and

if it is determined that a periodic registration time interval is  
14 not included in the registration time interval is not included in the registra-  
tion accept message, using, for periodic registration of the mobile terminal  
16 with the wireless communications system, a default periodic registration  
time interval.

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23. A mobile terminal used in a wireless communications  
2 system comprising:

4 a receiver receiving a registration accept message from the  
wireless communications system and determining if a periodic registration  
6 time interval associated with the mobile terminal is included in the registra-  
tion accept message;

8 a memory storing the periodic registration time interval associ-  
ated with the mobile terminal; and

10 a controller using the periodic registration time interval stored  
in the memory for periodic registration of the mobile terminal with the  
wireless communications system.

24. The mobile terminal of claim 23 wherein the controller  
2 uses a default periodic registration time interval stored in the memory if it  
is determined that the periodic registration time interval is not included in  
4 the registration accept message.

25. The mobile terminal of claim 23 wherein the receiver  
2 receives the registration accept message during initial power up.

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26. A wireless communications system comprising:

2 plural base stations, one of the base stations communicating  
with a mobile terminal within an area of coverage of the wireless communi-  
4 cations system; and

a mobile switching center operatively associated with the  
6 plural base stations for receiving an initial registration message from the  
mobile terminal, the registration message identifying the mobile terminal,  
8 determining a mobility classification assigned to the mobile terminal and  
transmitting a registration accept message to the mobile terminal indicating  
10 that the mobile terminal has successfully registered on the wireless commu-  
nications system, the registration accept message comprising the deter-  
12 mined mobility classification assigned to the mobile terminal.

27. The wireless communications system of claim 26 wherein

2 the mobile switching center receives a periodic registration signal at a  
periodic time interval associated with the determined mobility classification  
4 of the mobile terminal.

28. The wireless communications system of claim 26 wherein

2 the mobile switching center instructs mobile terminals assigned to a partic-  
ular mobility classification not to use periodic registration if a periodic time  
4 interval is not provided for the particular mobility classification.



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29. The wireless communications system of claim 28 wherein  
2 the mobility classification is selected from high mobility, low mobility or no  
mobility.

30. The wireless communications system of claim 28 wherein  
2 the periodic time interval associated with high mobility is of a  
shorter duration than the periodic time interval associated with low mobil-  
4 ity; and

the periodic time interval associated with low mobility is of a  
6 shorter duration than the periodic time interval associated with no mobility.

31. The wireless communications system of claim 26 wherein  
2 the mobility classification assigned to the mobile terminal is stored in a  
home location register associated with the mobile terminal.

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32. A wireless communications system comprising:

2 a mobile terminal;

4 a base station for communicating with the mobile terminal within an area of coverage of the wireless communications system; and

6 a mobile switching center operatively associated with the base station for receiving an initial registration message from the mobile terminal, the registration message identifying the mobile terminal,

8 determining a mobility classification assigned to the mobile terminal and transmitting a registration accept message to the mobile terminal indicating

10 that the mobile terminal has successfully registered on the wireless communications system, the registration accept message comprising the

12 determined mobility classification assigned to the mobile terminal,

14 the mobile terminal receiving the registration accept message and determining if the mobility classification is included in the registration accept message and periodically registering the mobile terminal with the

16 wireless communications system at a time interval associated with the mobility classification.

33. The wireless communications system of claim 32 wherein

2 the mobility classification comprises a timer value.

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2           34. A method of periodically registering a mobile terminal  
with a wireless communications system, said method comprising:

4           receiving a registration accept message from the wireless  
communications system and determining if a periodic registration interval  
6           associated with the mobile terminal is included in the registration accept  
message;

8           storing the periodic registration time interval associated with  
the mobile terminal; and

10          using the periodic registration interval stored in the memory for  
periodic registration of the mobile terminal with the wireless  
communications system.

2           35. The method of claim 34 further comprising using a default  
periodic registration time interval stored in the memory if it is determined  
4           that the periodic registration interval is not included in the registration  
accept message.

2           36. The method of claim 34 wherein the registration accept  
message is received during initial power up.

2           37. The method of claim 34 wherein the periodic registration  
interval comprises a mobility classification.

2           38. The method of claim 34 wherein the periodic registration  
interval comprises a time interval.

FIG. 1

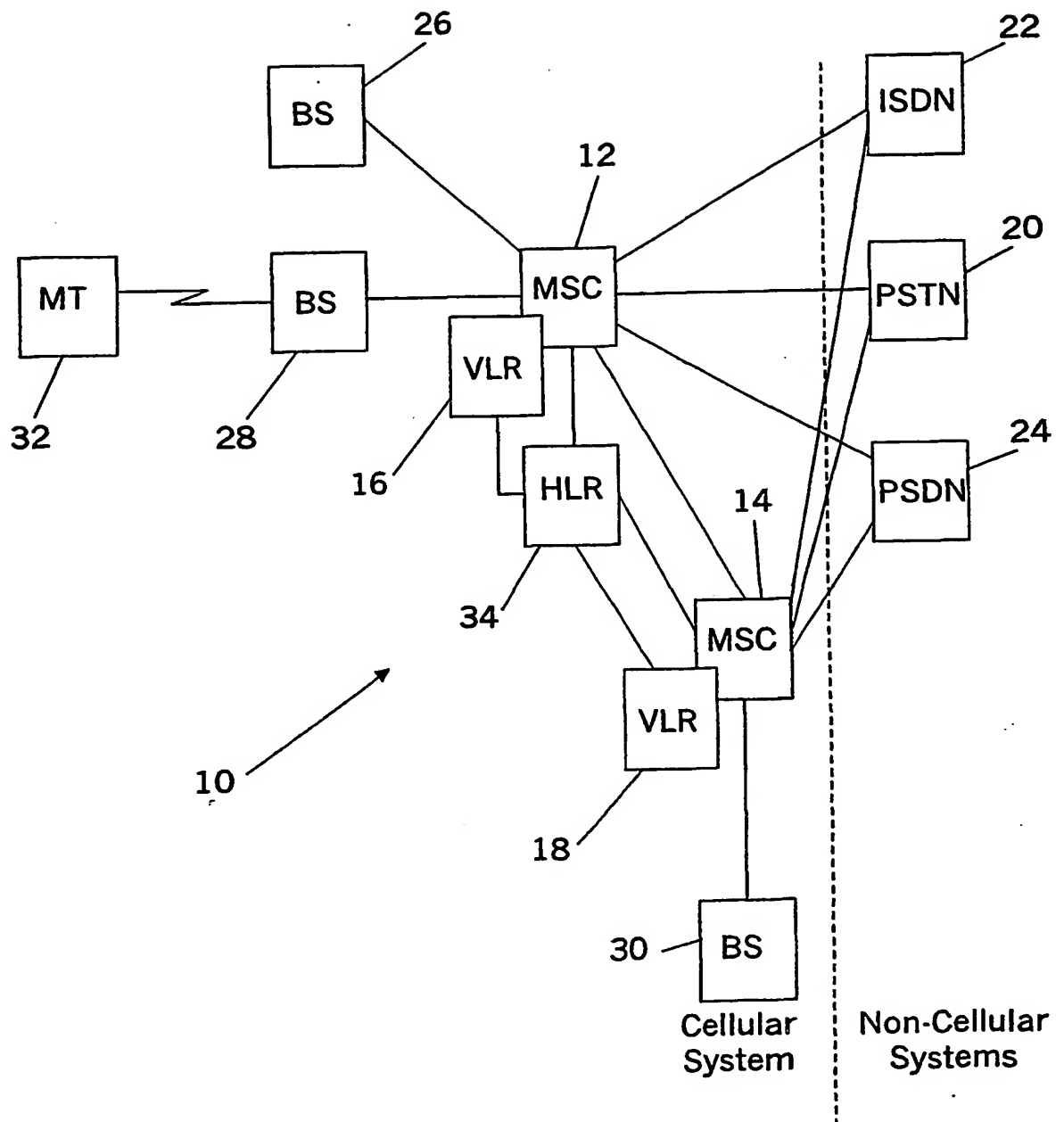


FIG. 2

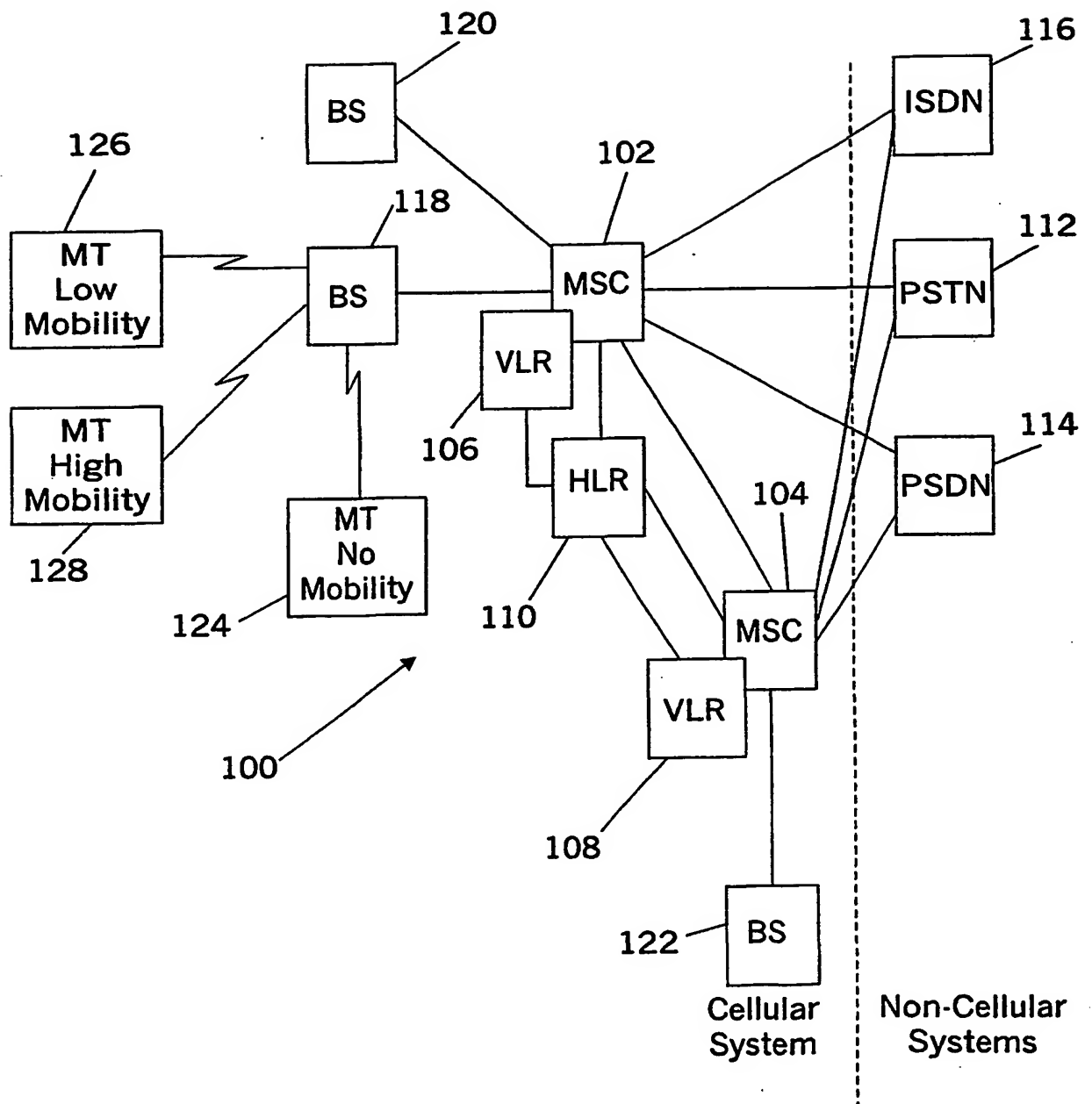


FIG. 3

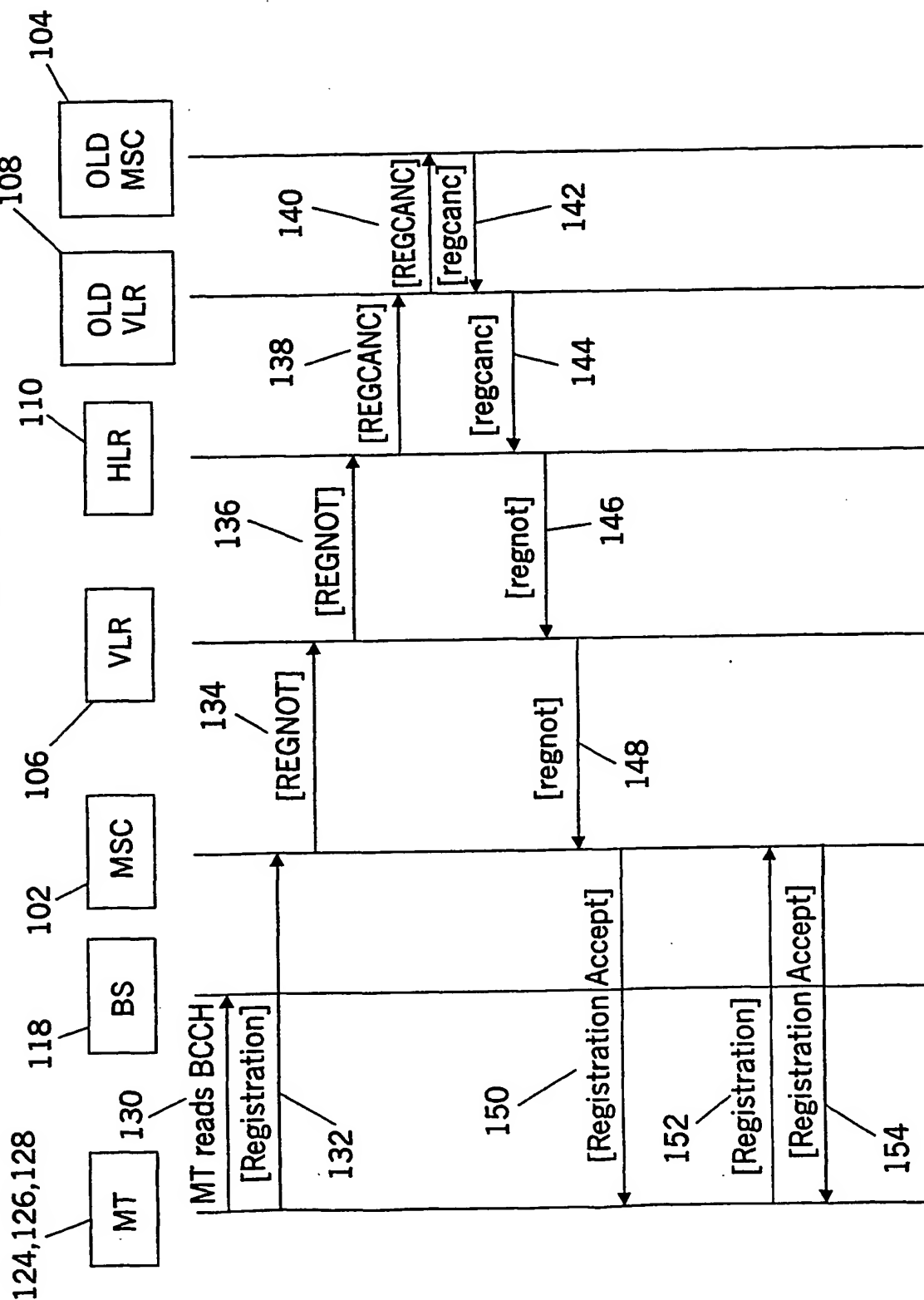


FIG. 4

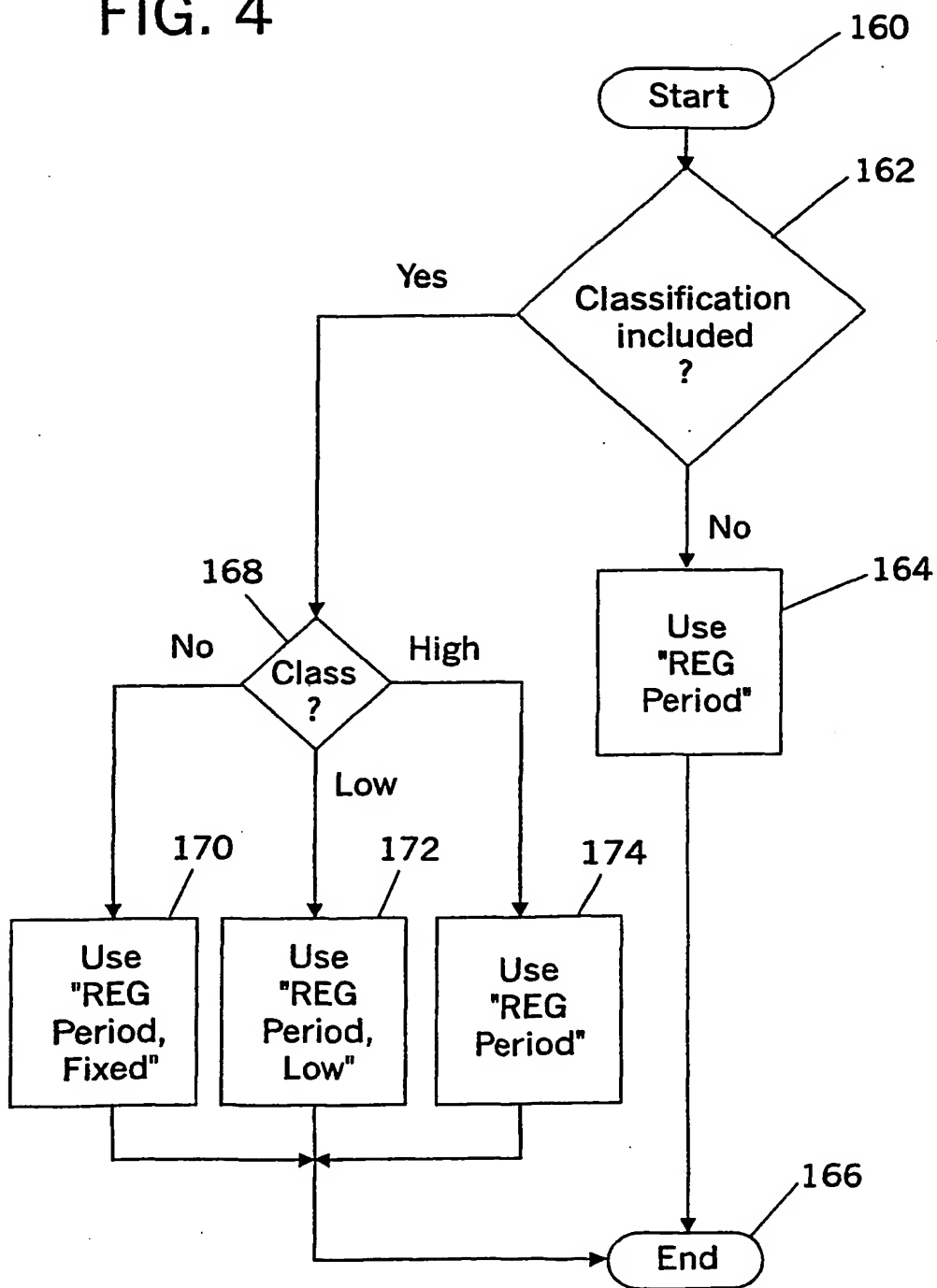


FIG. 5

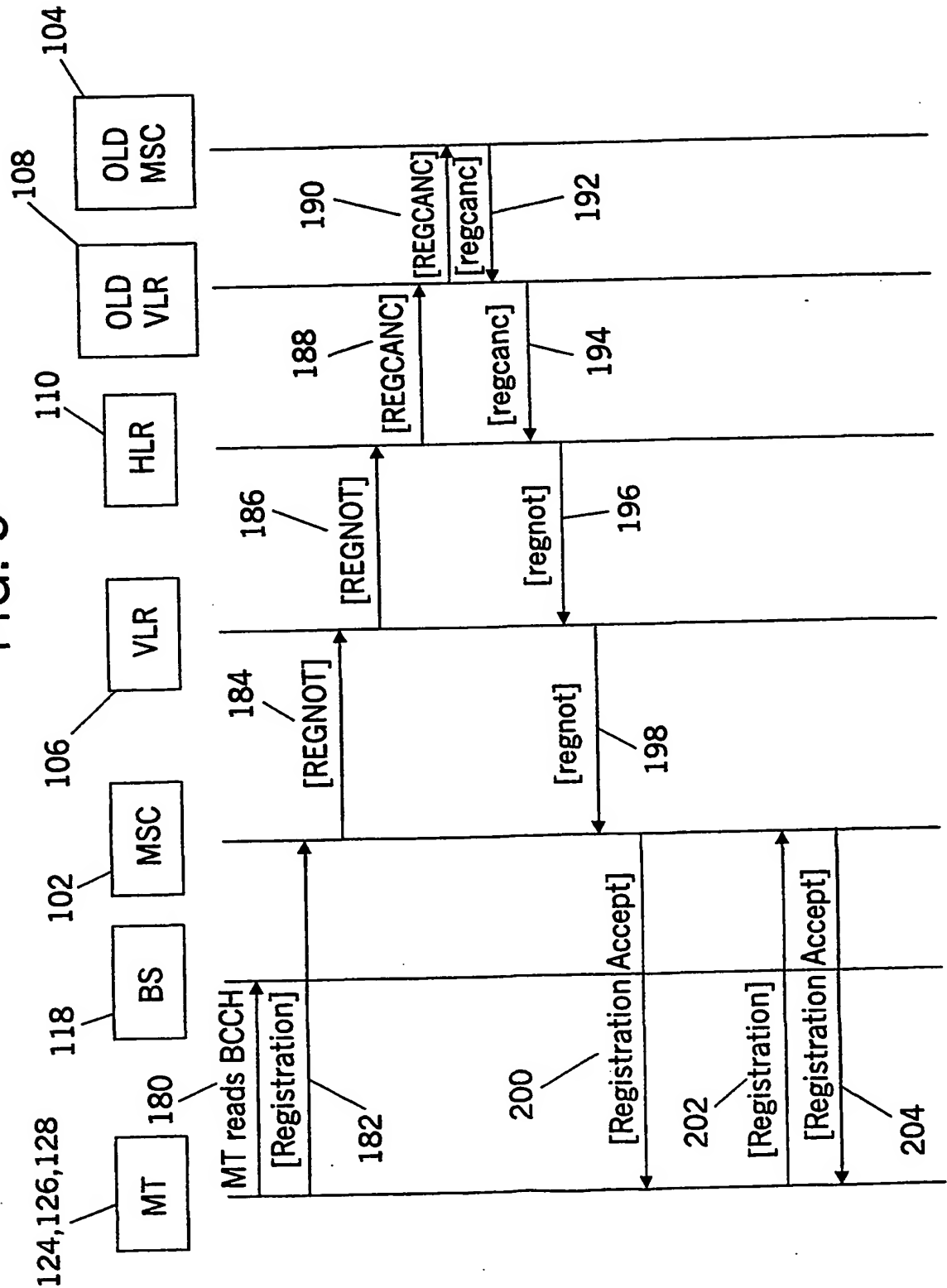




FIG. 6

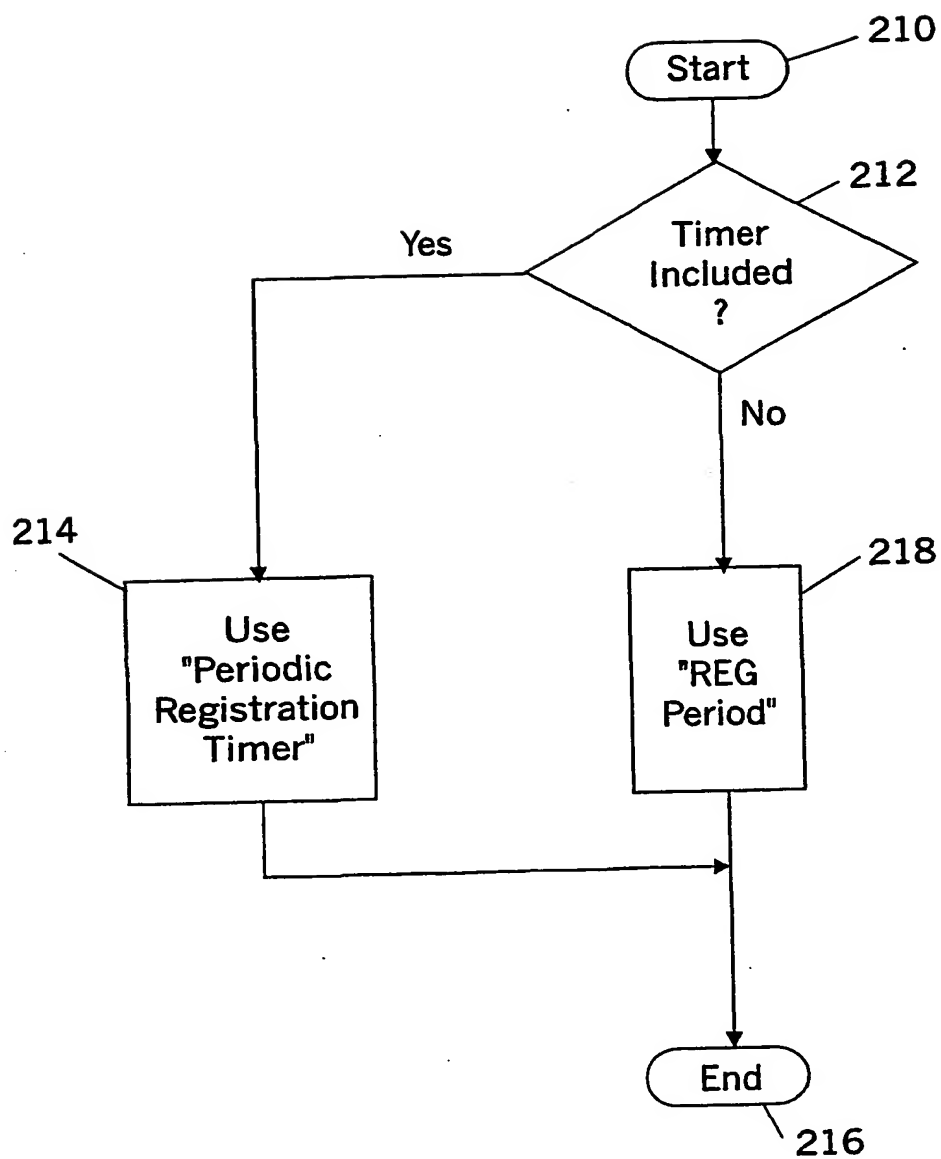


FIG. 7

